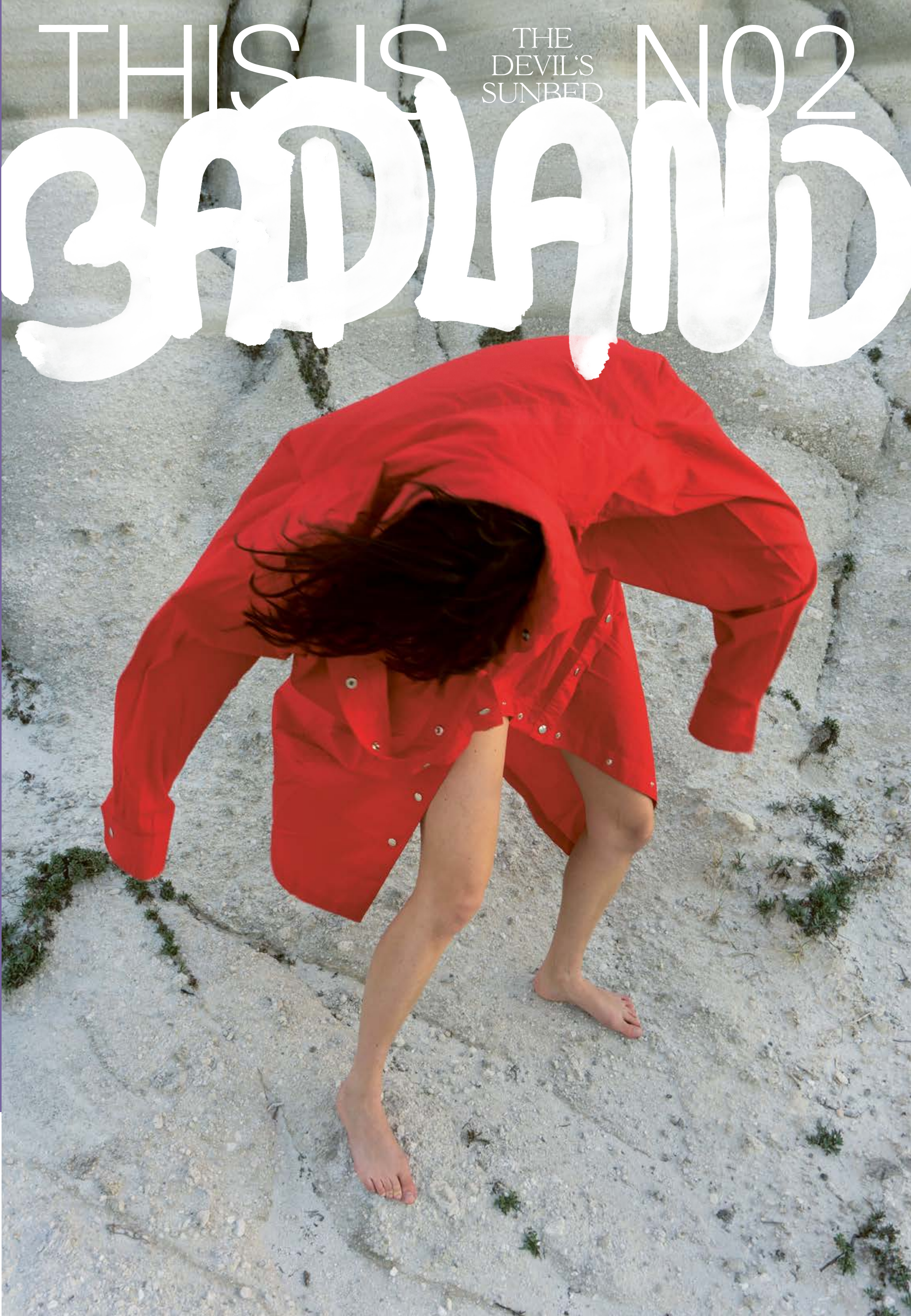
THIS IS BADLAND

THE DEVIL'S SUNBED

N02



RITA LINO

DECOR HARDCORE

RAMIĆ

MEGA

BOGOMIR DORINGER

STOYA

CHOPOVA LOWENA

14€

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THINKING IMAGES
ČČČAAČF
BY ADRIANA RAMIĆ
WITH LEO RAMIĆ

My parents arrived to the US shortly before my birth: my father from former Yugoslavia (present-day Bosnia), and my mother from Poland via London. Circumstances prevented them from teaching me their respective languages when I was young enough for childhood fluency. Attempting to fill the void by studying Bosnian and Polish as an adult has felt analogous to artificial intelligence techniques — feeding data sets of image-concept pairings into my brain so it could then regurgitate them in unconvincing reconfigurations.

LEFT AND TOP: Courtesy of Leo Ramić

What did it mean to be human in English, and then in Bosnian? How were these image-concept pairings stand-ins for the realities they signify?

A program, speaking the words for me instead, could become a sparse forest standing thinly between me and the fleshy discomfort of human error and the shame of ignorance. I wondered if it would make any difference to interpret as a computer, rather than a human. A bewildering, dull breeze seems to drift through culture-worlds separated without a communicative interchannel. In other words: MAYBE TYPICAL FIRST-GENERATION DIASPORA INADEQUACIES, TOO COMMONPLACE TO FEEL WORTH ELABORATION, WHERE COMMITTING TO A BELONGING COULD FEEL LIKE A VIOLENT ERASURE.

The consequences and residues of interpreting language, mediated through machine intelligences, have been central in my works as an artist. 'Walking Anemone (Hedgehog, Sock)', 2016, drew from a neural network trained on a defunct Croatian hedgehog caretaker's blog, rewriting its texts for the present and assigning them to numbered nodes in space. 'The Return Trip is Never the Same', 2014, imagined what would have happened if centuries-old ants walked on gestural keyboards in every language in the world.

I first learned to program from my father, who began programming in the late 70s in former Yugoslavia. In addition to technical knowledge, hearing about his experiences of that time was influential — in particular, learning about the reception of a program he wrote, re-encoding the then President Josip Broz Tito's image into a dot matrix text printout. Here, we have a conversation about what it was like to be a programmer then, and what happened with the dot matrix Tito.

ADRIANA RAMIĆ How did you get into computation?

LEO RAMIĆ Computers were a novelty when I began studying them, much more so in Yugoslavia than in the USA, so computer programmers were an extra rare species in my area. The use of computers spread rather quickly and, by the time I graduated, many companies had some kind of a computer.

As a child I wanted to be an astronaut. I still remember seeing pictures of the first space traveller, Laika, a dog, in newspapers. My hometown in central Bosnia, near Travnik, had a large military factory, called 'Brotherhood' (named after Yugoslavia's motto: "Brotherhood and Unity"). Officially, this was claimed to be a truck factory. But all the trucks coming out carried a large cargo in the back, covered with military green or camouflage covers. And many residents worked there, so it was not a secret to anyone in town that the factory actually produced tanks, howitzers and moreover rockets. This naturally led to my study of mechanical engineering, the closest subject related to astronomy. However, after four years of studying the laws of physics, engines and related things, I wanted to learn more about other subjects.

Then I happened to read the book *Cybernetics* by Norbert Wiener. The intro dedicated the book to freeing the humans from the drudgery of boring and uncreative tasks in information processing, and compared this to the machines freeing the humans from slave labour as muscle power in the galleys of ships. THIS CAUGHT MY INTEREST; WHO WOULDN'T WANT TO FREE THE HUMANKIND OF MODERN-DAY SLAVERY? The subject of computers was entirely new, and it also appeared challenging; that sealed the deal.

In the late 70s in Yugoslavia, computer science was mostly relegated to a couple of courses within the math or electrical engineering schools. Luckily, just in time for my university decision, the University of Zagreb formed a 'real' computer science program — devoted to mostly computer topics as the core. I enrolled as soon as I could, and the rest is history.

What types of projects did you work on as a programmer in Yugoslavia? What sort of computers and languages did you use?

While computers were expected to relieve the humans of mundane tasks, I spent the early days as a human doing the mundane tasks of teaching computers how to compute. The first office mini-computer I worked with in Yugoslavia didn't know even how to divide or round numbers, so I had to write programs for these elementary things. Programming early computers was a tedious and time-consuming affair. There was just enough space to do basic calculations, so results had to be stored on magnetic tape or other devices, and shuttled in and out of computer memory. And there was no room for a programming language, so programming had to be done using machine codes. Binary numbers are the only thing computers understand, even today. We used one shortcut, translating binary into hexadecimal numbers, so the codes were slightly easier to enter, and the machine code looked like this: 1A 3B 2C 44 78 AA 0A 00... and so on.

When I moved onto large computers, I worked mostly on IBM mainframes — the largest business computers of the era. Programming on large computers was much easier, because they had programming languages. Instead of entering a series of numerical codes, programs could be written in English-like languages, such as COBOL, PL1, and many others. As a System Programmer in charge of the operating system and other software controlling the 'magical' electronics within, I still often had to use the machine code, but this was eased with the machine translator program (Assembler).

Then IBM released the first mass-produced PC in 1981. However, PCs were already old news to many programmers, even to me in Yugoslavia. My graduate thesis, completed a year before the IBM PC release, was titled: *Implementation of a microprocessor to build a computer, with an example*.

There were also mini-computers, in between the large 'mainframe' computers and PCs, for those who needed more than personal computers could provide but could not afford or justify the cost of 'big iron' computers. My university, like most universities around the world, used mini-computers. So I used mini-computers at university, while using a large computer at work, and micro-computers for hobby projects.

When I was trying to research computers from that era in Yugoslavia, I kept getting the impression that a lot of hardware was difficult to obtain...

I did not own any computer while in Yugoslavia. I could not afford one, but had the skills, friends who couldn't afford getting the skills, but their parents had the money instead.

Were the mini-computers or micro-computers you mentioned earlier like Voja Antonić's Galaksija build-it-yourself computer that people could make themselves at home?

Big computers were very expensive, so only large companies and banks with access to convertible currency could afford buying one. Galaksija, and other PC clones, started appearing later, around the time when I was leaving Yugoslavia.

From your account it sounds like you had advanced access — at least within institutions. To what degree were computers moderated by institutions?

This depends on the year. As I mentioned before, computers spread rather quickly. I used a small mini-computer at work while studying, wrote a thesis on building a PC before IBM PC, and after graduating worked on a big IBM mainframe computer.

The IBM mainframe computers occupied a large room or two, which had to be specially built with heavy-duty air conditioning and raised floors to bury the thick cabling between components. They cost millions of dollars, plus tens of thousands of dollars monthly for maintenance and software. And they required large staff to program and operate. This was serious money, much more so for a small country like Yugoslavia. So only big companies and financial institutions had big computers, and data processing departments that accompanied them. I also worked on the first inexpensive micro-computers which were available in Yugoslavia, and which my friends had. These were Sinclair micros, made in the UK.

As an aside, thinking about other things I read on the internet, I heard that YUSCII, the Yugoslav ASCII, was called žabeceda (frog alphabet), since the first letter to appear, before 'A', was 'Ž'. Did you use that term, or is it just hypertext lore?

[LAUGHS] I've never heard of žabeceda until now. It's a clever term, but probably made up recently.

Yeah, apparently the 'Ž' was placed in the position of '@', and @ sorts before A in ASCII. Though now it's all about Unicode. Even so, like you said, it will all end up in binary (even if quantum). I remember once you jokingly affirmed that Bosnian-Croatian-Montenegrin-Serbian language could be quantum, too, because of its double negatives like 'nitko nije došao' (which

literally translates to 'nobody didn't come' but actually means 'nobody came').

Thinking in double negatives may help with understanding and overcoming the limitations of logic. The Bosnian language has that property of defying logic, like quantum mechanics, so in that sense it could be quantum (or extra-logical).

When you were working in northwest Bosnia in 1980 you had made a dot matrix image-printing program that printed a computed picture of Tito, what urged this?

I made the image-printing program for a specific purpose: to print an artistic depiction of Tito. When Tito became ill, most people in Yugoslavia became concerned — not only for his fate, but for the fate of the country as well. Tito had established a rotating presidency to succeed him, with representatives of each republic taking the helm in turns, but no one knew whether this seemingly great scheme would hold Yugoslavia together. The country did not panic, but the mood was subdued.

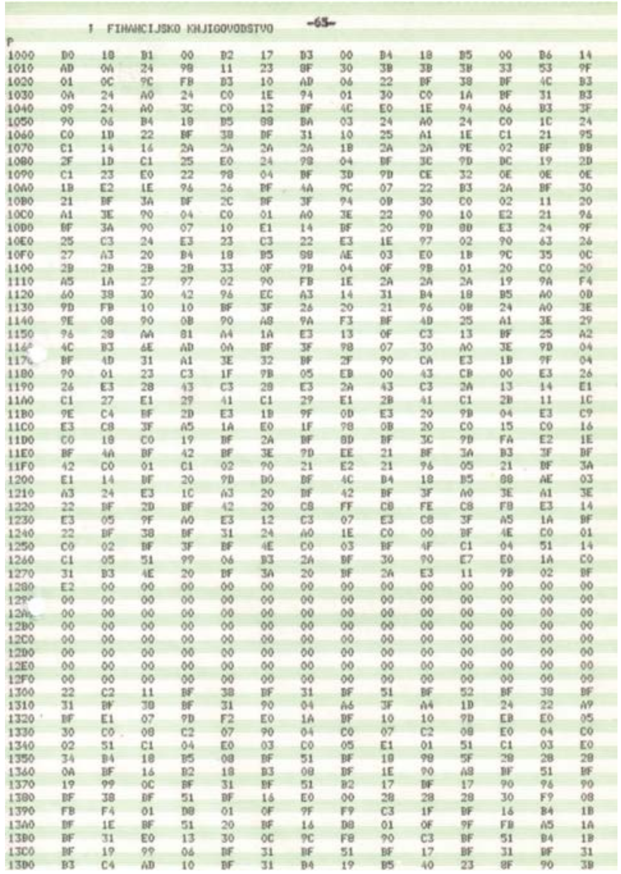
When it was reported that Tito had one leg amputated, to prevent the spread of gangrene, many started worrying what would happen next. It was in this atmosphere that I decided to make a program to reproduce an image of Tito on the computer and print it for anyone who wanted one.

What did it look like, and how did you do it?

The image of Tito was a shadow-art reproduction of his picture, similar in style to the widely known, and worn on T-shirts in the 70s, image of the Marxist guerrilla leader Che Guevara.

I formed the image by carefully arranging spaces and appropriate letters within the line, and line by line from top to bottom. The result appeared from up close as a random jumble of characters, but when viewed from some distance it was easily recognisable as the image of Tito's head.

Encoding this image into a program was a slow and tedious work. The mini-computer I used had very little memory, so I had to keep saving the work onto a magnetic tape. The computer had no programming language, so I had to type in machine codes for the program, and hexadecimal numbers for the characters forming the image. For example, I typed into a computer lines similar to this: 0A 3C FA 4F A1



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        I  FINANCIJSKO KNJIGOVODSTVO        -65-
P
1000    D0   18   B1   00   B2   17   B3   00   B4   18   B5   00   B6   14
1010    AD   0A   24   98   11   23   8F   30   3B   3B   3B   33   53   9F
1020    01   0C   9C   FB   B3   10   AD   06   22   BF   38   DF   4C   B3
1030    0A   24   A0   24   C0   1E   94   01   30   C0   1A   BF   31   B3
1040    09   24   A0   3C   C0   12   BF   4C   E0   1E   94   06   B3   3F
1050    90   06   B4   18   B5   08   BA   03   24   A0   24   C0   1C   24
1060    C0   1D   22   BF   3B   DF   31   10   25   A1   1E   C1   21   95
1070    C1   14   16   2A   2A   2A   2A   1B   2A   2A   9E   02   BF   DB
1080    2F   1D   C1   25   E0   24   98   04   BF   3C   9D   DC   19   2D
1090    C1   23   E0   22   98   04   BF   3D   9D   CE   32   0E   0E   0E
10A0    1B   E2   1E   96   26   BF   4A   9C   07   22   B3   2A   BF   30
10B0    21   BF   3A   DF   2C   BF   3F   94   0B   30   C0   02   11   20
10C0    A1   3E   90   04   C0   01   A0   3E   22   90   10   E2   21   96
10D0    BF   3A   90   07   10   E1   14   DF   20   9D   8D   E3   24   9F
10E0    25   C3   24   E3   23   C3   22   E3   1E   97   02   90   63   26
10F0    27   A3   20   B4   18   B5   98   AE   03   E0   1B   9C   35   0C
1100    2B   2B   2B   2B   33   0F   9B   04   0F   9B   01   20   C0   20
1110    A5   1A   27   97   02   90   FB   1E   2A   2A   2A   19   9A   F4
1120    60   38   30   42   96   EC   A3   14   31   B4   18   B5   A0   0D
1130    9D   FB   10   10   BF   3F   26   20   21   96   0B   24   A0   3E
1140    9E   08   90   0B   90   A8   9A   F3   BF   4D   25   A1   3E   29
1150    96   2B   AA   81   A4   1A   E3   13   0F   C3   13   BF   25   A2
1160    4C   B3   6E   AD   0A   BF   3F   98   07   30   A0   3E   9D   04
1170    BF   4D   31   A1   3E   32   BF   2F   90   CA   E3   1B   9F   04
1180    90   01   23   C3   1F   9B   05   EB   00   43   CB   00   E3   26
1190    26   E3   28   43   C3   28   E3   2A   43   C3   2A   13   14   E1
11A0    C1   27   E1   29   41   C1   29   E1   2B   41   C1   2B   11   1C
11B0    9E   C4   BF   2D   E3   1B   9F   0D   E3   29   9B   04   E3   C9
11C0    E3   C8   3F   A5   1A   E0   1F   78   0B   20   C0   15   C0   16
11D0    C0   18   C0   19   BF   2A   BF   8D   BF   3C   9D   FA   E2   1E
11E0    BF   4A   BF   42   BF   3E   7D   EE   21   BF   3A   B3   3F   DF
11F0    42   C0   01   C1   02   90   21   E2   21   96   05   21   BF   3A
1200    E1   14   DF   20   9D   D0   BF   4C   B4   18   B5   88   AE   03
1210    A3   24   E3   1C   A3   20   DF   42   BF   3F   A0   3E   A1   3E
1220    22   BF   2D   BF   42   20   C8   FF   C8   FE   C8   FB   E3   14
1230    E3   05   9F   A0   E3   12   C3   07   E3   C8   3F   A5   1A   BF
1240    22   BF   38   BF   31   24   A0   1E   C0   00   DF   4E   C0   01
1250    C0   02   BF   3F   BF   4E   C0   03   BF   4F   C1   04   51   14
1260    C1   05   51   99   06   B3   2A   BF   30   90   E7   E0   1A   C0
1270    31   B3   4E   20   BF   3A   20   BF   2A   E3   11   9B   02   BF
1280    E2   00   00   00   00   00   00   00   00   00   00   00   00   00
1290    00   00   00   00   00   00   00   00   00   00   00   00   00   00
12A0    00   00   00   00   00   00   00   00   00   00   00   00   00   00
12B0    00   00   00   00   00   00   00   00   00   00   00   00   00   00
12C0    00   00   00   00   00   00   00   00   00   00   00   00   00   00
12D0    00   00   00   00   00   00   00   00   00   00   00   00   00   00
12E0    00   00   00   00   00   00   00   00   00   00   00   00   00   00
12F0    00   00   00   00   00   00   00   00   00   00   00   00   00   00
1300    22   C2   11   BF   38   DF   31   BF   51   BF   52   BF   38   DF
1310    31   BF   38   BF   31   90   04   A6   3F   A4   1D   24   22   A9
1320    BF   E1   07   9D   F2   E0   1A   BF   10   10   9D   EB   E0   05
1330    30   C0   08   C2   07   90   04   C0   07   C2   08   E0   04   C0
1340    02   51   C1   04   E0   03   C0   05   E1   01   51   C1   03   E0
1350    34   B4   18   B5   08   BF   51   BF   18   98   5F   28   28   28
1360    0A   BF   16   B2   18   B3   08   DF   1E   90   A8   BF   51   BF
1370    19   99   0C   BF   31   BF   51   B2   17   BF   17   90   96   90
1380    BF   38   DF   51   BF   16   E0   00   28   28   28   30   F9   08
1390    FB   F4   01   D8   01   0F   9F   F9   C3   1F   DF   16   B4   1B
13A0    DF   1E   BF   51   20   BF   16   D8   01   0F   9F   FB   A5   1A
13B0    BF   31   E0   13   30   0C   9C   F8   90   C3   BF   51   B4   1B
13C0    BF   19   99   06   DF   31   BF   51   BF   17   BF   31   DF   31
13D0    B3   C4   AD   10   BF   31   B4   19   B5   40   23   8F   90   3B
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LEFT: Courtesy of Adriana Ramić

RIGHT: A dot matrix printout using the same hardware and method as for the Tito portrait prints, 1980. Computer print, ink/ribbon, TERA-2 dot-matrix printer programmed in Z80 machine code, produced at University of Zagreb, courtesy of Leo Ramić

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Polukružni luk

BB 3C 20 20 3C E5… and so on. The program then printed a line similar to this: …ORRXXXXTL;… LMNNNXA;… Obviously, there was no visible relation between the codes I typed, and the output produced. Worse yet, the computer had no display at all, not even a one line display that simple calculators had.

This meant that the programming process involved guessing which character should be placed in which position, then typing like the blind, then printing the result on the printer, and looking at it from a distance to see whether proper characters are in proper place. Then editing, correcting and adding codes, for hours on end. This process took many hours over several days.

And then you printed them out?
What did you do with them?

When the program was finished, I printed the output on the green-bar paper, which was the standard paper for business reports back then, on the dot matrix printer, which was the only type of printer available at that time. I printed out a thick stack of these images, which took another half a day, and placed them on a table in the hallway. Many people took the printouts home, and by the morning, all copies were gone.

The next day the announcement came: Tito was dead. While this was not unexpected, many were still shocked and speechless. I remember seeing that day one policeman I knew running towards the police station, and visibly crying and wiping off his tears on the run. That was the reaction of most of the country as well. I respected Tito for his accomplishments, but did not idolise him, or anyone else, so I was not looking forward to the predictable many days of endless mourning and mementos, whether genuine or contrived for decor.

One reaction that I did not expect was relayed to me when I arrived to work: the police visited the company and asked the management who, how, when and why that image of Tito was made and disseminated it just before Tito died. They followed up with inquiries about me and my history. Fortunately, they accepted the explanation that it was just a coincidence, so I did not have to explain all the gory details of programming an image.

P. 46–49: Installation view, *Machine that the larvae of configuration*, 2018. Elementary school Đura Jakšić, Banatski Dvor, Serbia. Photo by Relja Ivanić

Did any of the prints survive today?

No idea how many prints survived, if any. I know I brought at least one copy with me to the US, but don't know if it still exists and where..

Did you print any other images with that program?

Because of memory limitations, the program for the shadow-art image was intricately enmeshed with the image format, so printing a different image required a lot of reprogramming work. However, the company that made the computers that I made this program for, then used this program to reprint the same image on a computer trade show, and received a lot more orders, so my work was widely seen (and made indirectly money on).

What did you think of people working around that time, or earlier, with computation in an artistic context — particularly those sort of computer-translated photos? New Tendencies exhibitions seemed to had strong presence in Yugoslavia from 1961–1973, gathering local and international artists informed by aesthetics of information age, which was just rising. For instance, I'm reminded of Vilko Žiljak's computer-generated Ki images when I think about that dot matrix image printing technique you used.

I was not aware of these New Tendencies exhibitions, because most took place long before my computer studies. I recall seeing a computer printed image back then — it is quite possible that it was one of their works.

I followed the political movements of the time, and one of these had a similar name. But that 'new wave' movement carried a different message, largely nationalistic, and did not last long. In one of his rare TV appearances, Tito mentioned that there were some tendencies in academic circles that sought to divide the country along the old lines, and that they had some support from the West, but that he would not yield to those pressures.

How did your perspectives on cybernetics and computation change? Like now, when we're already experiencing the dark sides of technology and automation?

One of my early projects was a computer art app for my artist friends. They had an inexpensive microcomputer and asked me to program something for it. I made a program that drew an artwork, repeatedly in a loop. Even though the artwork was fairly simple: a pyramid in a desert, with the sun above, those were early days of computers and they were mesmerised by it.

This led to debates about 'deus ex machina', the future with computers creating original art, writing books where readers could change the ending or sequence, and so on. Most believed that computers would reach far beyond the vision from Wiener's *Cybermatics*, with computers just relieving humans of mundane information processing tasks.

However, back then the day of computers competing with humans seemed very distant to me. To produce any results, computers had to be taught everything: every single step of the process had to be described in every detail, or there will be no result, or the result will be wrong. For those in the know, computers were 'garbage in, garbage out' machines.

Machines are very likely to some day exceed most humans in cognitive tasks, but with current methods such achievement would be far from ideal. Machines that are as prone to error as humans, and that produce results that cannot be fully verified and trusted, might produce more usable results faster than an average human — but they would be far from surpassing the humankind. The ultimate goal is for machines to do most of what we do, better than we do it. But that requires teaching the machine how to do something, which requires the teacher to understand the subject well enough. However, the teachers do not yet understand how the mind works, and machines are unlikely to discover this by some random method.

That's reassuring.

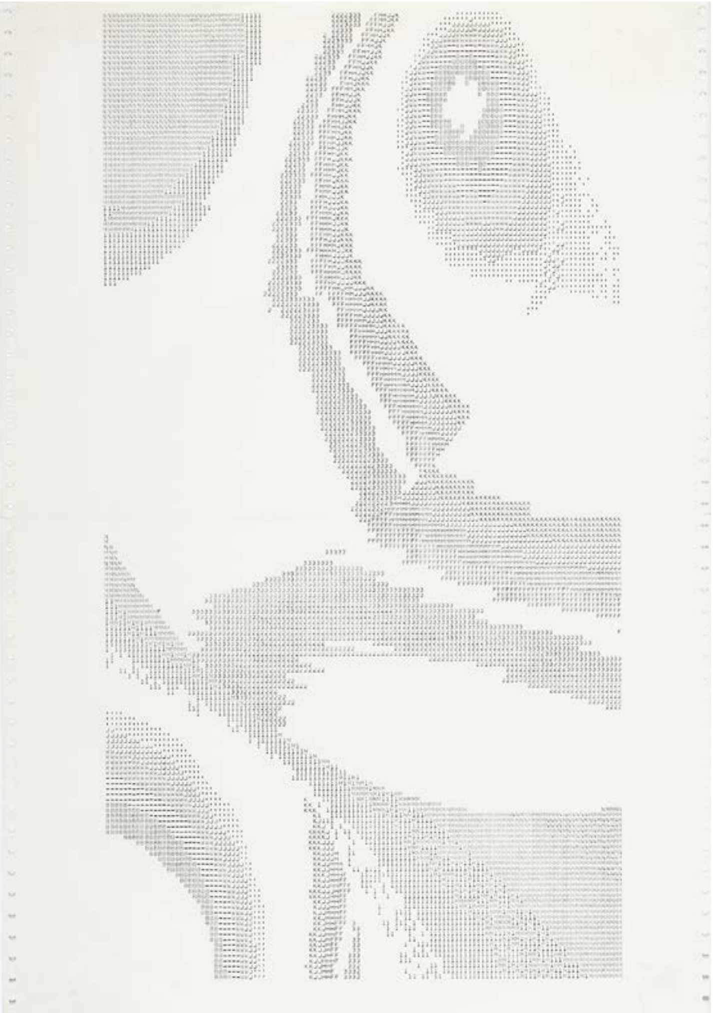
After I graduated in computer science, I continued with graduate studies in artificial intelligence. One day I received a book that I did not order. It was a spam mailing from the infamous 'Book of the Month', which sent everyone a random selection of books in the hope that someone would keep some book (and pay for it). The book was titled: *How to Program the Computer to Program Itself*. This was, of course, not anywhere close to being possible at that time (the book was just an introduction to basic programming language). That book made me laugh back then. Despite all the advances in computers and machine learning since then, a freshly produced book with a similar title would also make me laugh today.

It was striking for me to hear my dad's story about how a dot matrix image program could inspire a police visit — a reminder of our own responsibilities and agencies in manipulating machines, and the suspicion that can be elicited by re-encoding an image alone. Since computers are not autonomously programming themselves (yet) their behaviour is very much connected to the intentions of the humans behind them.

What did reprogramming an image do, if a machine can see whatever you program it to see? Curious what would happen if I could ask a computer to interpret an image as a crude sequence of letters, I wrote a program, BUBAMARA-OCR, that could infer a text based on Latin alphabet from an image using a computer vision algorithm. Ladybirds, chosen for their roles as predictive and fateful messengers, both biologically observed and reimagined by generative adversarial networks, were the intermediary between photo and alphabet — each letter having its own corresponding ladybird. Whatever ladybird — each section of the image looked like most determined the letter that the program would output.

My friend Đorđe introduced me to his mother's school in Banatski Dvor, Serbia, where he had been compellingly photographing scenes and student artwork; we went there two summers ago and took pictures. Throughout classrooms, we found taxonomic posters outlining the anatomy of invertebrates, bees, slugs, and people, as well as alphabetical and grammatical references. A shelving unit in the entryway displayed insects pinned inside a styrofoam frame, behind jars containing specimens floating in formaldehyde, including a pig's brain, a squid, and a scorpion. Painted on classroom walls were snails, rabbits, frogs, and caterpillars twisting into question marks. A school naturally is a setting for the reinforcement of the image-concept pairs that comprise participation in a society, and as someone who didn't have a chance to properly learn the language in childhood, I wondered what I had been missing.

Maybe I couldn't understand everything that was going on, but BUBAMARA-OCR could try to decode the scenario; I hoped to see what sort of new meanings could be found in the photographs from the school. Each letter they wrote became a stand-in for something else, in a taxonomy of alphabetic polyvalence: an 'A' could imply anything from abažur, agonija, Armenija, or atom. I turned each letter of the texts generated by BUBAMARA-OCR into a flashcard with a photograph culled from data scraping and image recognition databases to illustrate this re-interpretation with an array of particular concepts, and then placed them according to the order of the text written by BUBAMARA-OCR, to remap and reimagine the source image over a new space. These image remappings were exhibited last year at Kimberly-Klark in New York alongside an earthwork, as well as at Super Dakota in Brussels, Veronica in Seattle, and New Galerie in Paris. This past February, I was also able to install many of them at the Đura Jakšić elementary school, which has felt like a beautiful recursive way to return them to their source.



Vilko Žiljak, *Ki 298*, 1972, computer-generated b/w print, 60.9 × 42 cm, programmed in FORTRAN, produced at Industroprojekt, Zagreb, courtesy of MSU Zagreb

Thanks to Đorđe and Snežana Vlaisavljević for their generosity and introduction to Osnovna Škola Đura Jakšić, Banatski Dvor.